Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

$(E)R^c(T)$ *mean to* T*?* has, in all this elaborate dialectic, only been prejudged and confused. And the solution offered is not only without a shred of evidence, but is charged with the support of a logical abortion.

I have not undertaken to do more than to isolate a species of dangerous reasoning that infests a certain region of philosophical inquiry. The question of the precise modification which a thing undergoes when it is known, is a proper problem; and the theory that that modification is profound, or even in some sense definitive, is a legitimate speculative alternative. But nothing whatsoever can be inferred from the mere ubiquity of that modification, from the mere fact that nothing can be found which is not thus modified. This self-evident fact simply defines the means that must be employed for the solution of the problem. We can not employ a method which in other cases proves a convenient preliminary step, the empirical, denotative method of agreement and difference. There remains, however, the method which must eventually be employed in any exact investigation, the method of analysis. The mere fact that T is invariably found in a certain complex, since it can not be corrected by the method of difference, must be set aside, and not allowed to weigh in our calculations. But we may still have recourse to that analysis of all the elements of the complex, of T, E, and R^c, which would be required in any case before our conclusions could assume any high degree of exactness. Having discovered just what an ego is, just what a thing is, and just what it means for an ego to know a thing, we may hope to define precisely what transpires when a thing is known by an ego. And until these more elementary matters have been disposed of we shall do well to postpone an epistemological problem that is not only highly complicated but of crucial importance for the whole system of philosophical knowledge.

RALPH BARTON PERRY.

HARVARD UNIVERSITY.

EDUCATIONAL PSYCHOLOGY IN THE SECONDARY SCHOOL[1]

THERE seem many reasons to believe that educational psychology has at the present day reached a critical stage in its development. Having for some years past enjoyed the approval of theorists on education, it is at length beginning to attract the attention of those actually engaged in the practise of teaching. Should it fail now to justify itself in the eyes of the latter, there can be no doubt that it will suffer a setback from which it will take many years to recover. Should, on the other hand, experienced teachers admit its claims, the results of school practise, expressed accurately in psychological terms, will go to swell the science itself, and we shall at last have—what we have *not* at present—an applied psychology of education.

---

[1] Paper read before the British Psychological Society.

The general objection to psychology brought forward by masters is that it teaches them little or nothing definite which they did not know originally or could not quickly gain from school experience. The majority would probably be willing to admit that the science is of general use in setting the mind in a certain direction, much as logic and methodology are. Their distrust of it for direct application is due mainly, I think, to the unsatisfactory state of the psychology of reasoning. The science of psychology fails just where the science of education has principal need of it. One of the prime functions of education is supposed to be the general or formal training of the intellect; but not even the possibility of such a formal training has yet been demonstrated. Much vague talk is indulged in by the unpsychological master about the "training of the logical faculty" imparted by different school disciplines. From a psychological point of view, reasoning is a question of matter as well as of form, and only scientific observation and experiment are competent to decide the relative importance of each. Theories of mental systems, apperception masses, etc., are far too general and vague for practical application. The division of conceptual process into *comparison* and *abstraction* on the one hand, and various forms of *constructive process* (as it is called) on the other—both classes being recognized as *productive process* working on the material supplied by memory and association—is likewise too vague a schema as it stands, although full of suggestion for more thoroughgoing analysis.

Modern experimental psychology, by employing experiment, simplifying the conditions, and, above all, by endeavoring to obtain quantitative answers to its questions, has placed itself in a much more promising position. Its ideal comes much closer to that of an applied science, such as the educational psychology of the future must be. Its methods, too, are such as must command ultimate success, if granted sufficient opportunity of application in the schools. An enumeration of the more prominent of these methods will show, however, that there is reason to fear that such opportunity may not be forthcoming to any great extent.

There is, in the first place, a large class of experiments for the investigation of the phenomena of practise and fatigue. Apart from the internal criticisms that can be passed on the ergographic, esthesiometric, and other tests employed, the fatigue measured in cases where no such criticism is applicable has been that produced by mechanical processes such as addition and multiplication under artificial conditions of interest, etc., so that the results can hardly be taken as typical for intellectual work done under school conditions.

For the determination of individual differences in mental capacity, innumerable tests have been devised, such as the relative and absolute thresholds in the various realms of sensation, the mean variation for these thresholds (taken as a measure of the attention), the estimation of space and time, reaction-times, the crossing out of words containing certain stated letters in a page of print, tachistoscopic experiments on perceptual processes (*e. g.*, reading), determination of association times; and so-called combination tests, such as those of Ebbinghaus, in which omitted words and syllables of pieces of prose have to be supplied by the subject. To many of these the objection can be made that they do not directly measure general mental capacity, and that the interpretation of their results as symptoms or signs of such is very uncertain; others do directly measure mental processes involved in intellectual work, but under conditions so artificial and so greatly simplified that their results are not readily applicable to ordinary experience.

In theory all these methods are justifiable, and in pure psychology they all find a rightful place. Yet it is extremely doubtful whether secondary schools will be ready, either now or in the immediate future, to devote the requisite amount of time for the application of such methods.[2] Schools have their own methods of measurement in the marking system, if system it can be called; and reform is more likely to come from within this system than from artificial experiment. Such a reform would have to be based on a most detailed analysis of the psychological processes involved in the learning of the various school subjects, and allocation of marks accordingly. The present system of taking the entire subject (*e. g.*, Latin or mathematics) as the unit is useless for scientific purposes, and the determination of correlation-coefficients for different pairs of subjects on the basis of *aggregate* marks is simply waste of time and trouble. Yet knowledge of the precise relations between one subject and another would be of the greatest help in the drawing up of a curriculum, and such knowledge would be obtainable from the correlation-coefficients[3] of corresponding fundamental mental processes involved in the learning of the two subjects. Assuming sufficient constancy of marking and a sufficient number of measurements, the correlation-coefficients calculated might in their turn be used to throw light on the accuracy of the original psychological analysis.

---

[2] In *primary* schools the experiments and tests above mentioned would in themselves possess considerable educational value, so that the objection propounded in the text would not apply in their case.

[3] For explanation of the principle of *correlation* and methods of calculating correlation-coefficients, see Karl Pearson: "Grammar of Science," 2d edition, Ch. X.; also see below.

Of course, the scientific analysis of a school subject, such as Latin or mathematics, is essentially a logical analysis, but if considered with reference to the demands made on the mind of the learner by the subject and the method of teaching the subject, and also with reference to the matter in which the logical forms are inherent, a psychological analysis emerges, which indeed closely follows, although it does not altogether coincide with, the logical one. Method has systematized each subject as a body of knowledge in which any one stage is logically as important and indispensable as any other; but for the learner these stages are of different values—make unequal demands on his memory, attention, etc., as is shown by the varying amounts of time and practise needed to surmount them.

Let us take mathematics as an illustration. Has mathematics a psychology as well as a logic? The subject is held to be unrivaled in its power of training the reasoning faculty. Now, Professor James, in his treatment of the psychology of reasoning, sums up the process as follows:[4]

"1. An extracted character is taken as equivalent to the entire datum from which it comes.

"2. The character thus taken suggests a certain consequence more obviously than it was suggested by the total datum as it originally came."

The psychological factors at work are, then, according to Professor James, "dissociation by varying concomitants" and "association by similarity."

These processes certainly occur at all stages of mathematical reasoning, but practical experience points to the need of a more extended analysis. The difference between problems and theorems in geometry, the exceptional difficulty experienced by many boys in grasping the mathematical principle of proportion, the astonishing variations in memory, apart from variations of interest, attaching to different parts of mathematics, stand out so prominently in practise and with such uniformity that psychological factors of great constancy and generality must be assumed to account for them.

Introspection gives little help in the analysis. Beyond individual differences in the form and vividness of the mental imagery employed, little can be thus directly distinguished. So much of the process seems to be subconscious, or even unconscious, that the greater part of its dissection will be achieved, if at all, only by the application of indirect methods.

---

[4] "Principles of Psychology," Vol. II., p. 340.

The method which I wish to suggest in this short paper is one based on the determination of *correlation-coefficients,* deriving its measurements from a *differential system of marking.* Of course, such a differential system of marking in itself presupposes some amount of preliminary analysis, but for this the logical analysis of the school-subject and the broad psychological distinctions already recognized by teachers provide an adequate first step. The subsequent course of the investigation would be, as it were, circular and yet progressive. The correlation-coefficients first calculated would point to more detailed psychological analysis, and this in its turn would increase the number and accuracy of coefficients subsequently obtained. Even after the limits of direct psychological analysis had been passed, the coefficients might yet serve to draw attention to the existence of psychological factors only observable in their physiological effects. The principle of this form of analysis by correlation-coefficients is common to all the objective sciences, though probably better known as "the method of concomitant variation." For the purposes of this paper it may be briefly stated thus: presumption of connection between any two processes, *i. e.,* of the existence of a still deeper-lying process common to both, will vary in strength in direct proportion to the size of the coefficient of correlation between them, calculated according to any of the well-known and approved methods.

The program sketched in outline above is one suited rather for the secondary than for the primary school, since it is one to be carried out, if at all, by the masters themselves. That it is a workable scheme, assuming psychological qualification and psychological interest on the part of the masters, I have little doubt.[5] Control experiments with trained subjects in the psychological laboratory would of course be simultaneously necessary, *i. e.,* the student of applied educational psychology would need to work hand in hand with the psychological specialist; but here again there should be found no insurmountable difficulty.

WILLIAM BROWN.

KINGS COLLEGE, LONDON.

---

[5] Towards the close of last year (1908), the writer applied the correlation-method indicated above to the analysis of elementary mathematical ability as displayed by a set of about eighty boys in an English public school. All the boys were examined on the same papers, and the coefficients that have been obtained show a tendency to harmonise with one another and with practical experience to a degree very encouraging for the method. The evaluation of the results (with corrections for the effects of extraneous conditions) is still in progress. An account of the research will be published shortly.